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WEBINAR

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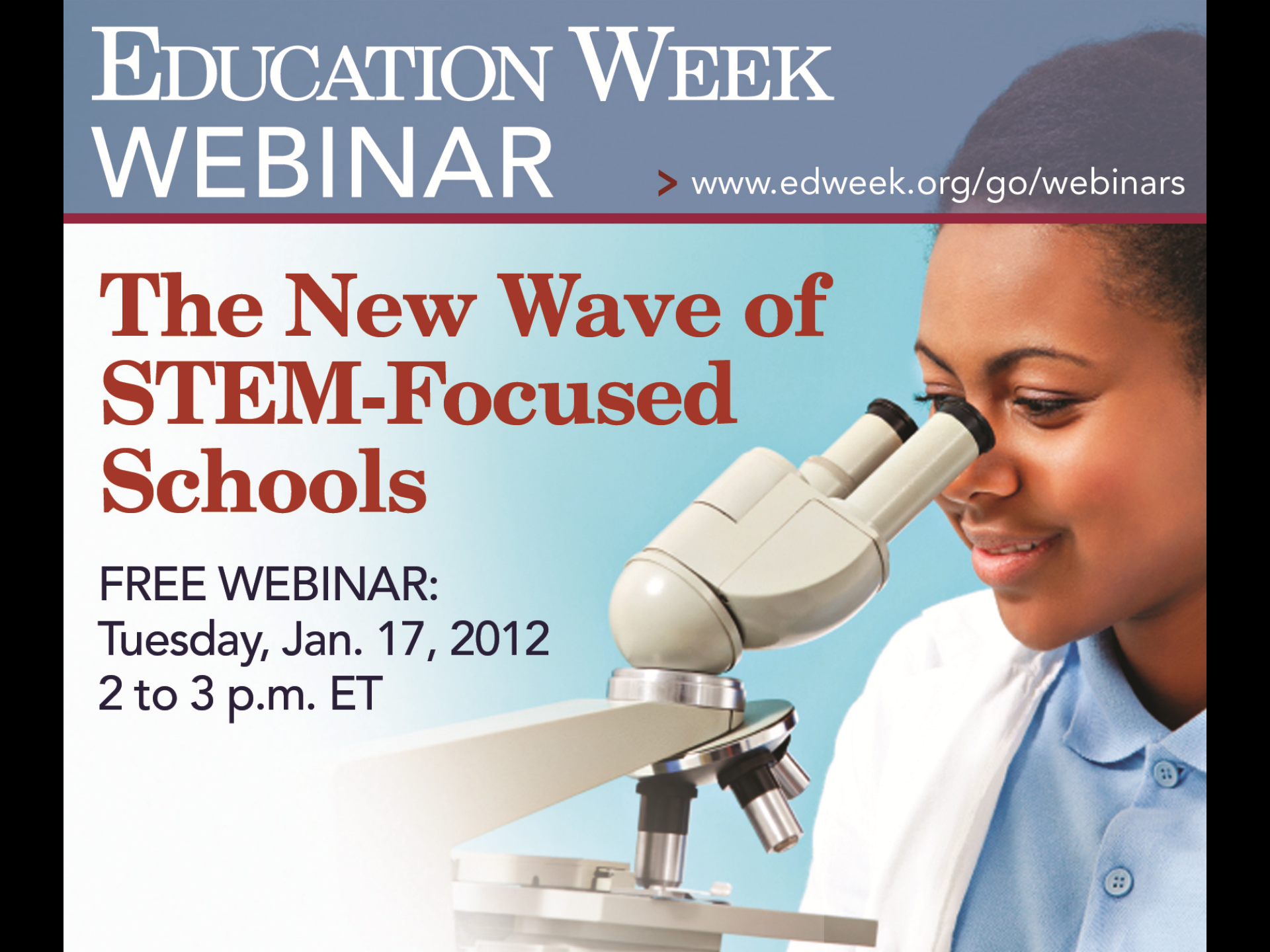
The New Wave of STEM-Focused Schools



FREE WEBINAR:
Tuesday, Jan. 17, 2012
2 to 3 p.m. ET

Erik Robelen
Assistant editor, *Education Week*

The New Wave of STEM-Focused Schools

Expert Presenters:

Sharon Lynch, science education professor, George Washington University

Steven Zipkes, founding principal, Manor New Technology High School, Manor, Texas

An on-demand archive of this webinar will be available at www.edweek.org/go/webinar in less than 24 hrs.

Inclusive STEM high schools: Improving educational opportunity and the economy

- Sharon J. Lynch
- The George Washington University
- Graduate School of Education and Human Development

Overview

- Background: Why are we seeing rapid growth in the creation of such schools?
- Taxonomy and trends for STEM-focused schools: Focus on groups of students under-represented in STEM.
- What does the research tell us about the benefits of STEM schools? Potential? Dangers?
- New NSF-funded research project: Opportunity Structures for Preparation and Inspiration (OSPrI) by Lynch, Means, Behrend, and Peters Burton.

What is a STEM-focused school?

What is STEM?
No common definition

- "…an *interdisciplinary* approach to learning where rigorous academic concepts are coupled with real-world lessons as students apply science, technology, engineering, and mathematics in contexts that make connections between school, community, work, and the global enterprise enabling the development of STEM literacy and with it the ability to compete in the new economy "(Tsupros, Kohler, & Hallinen, 2009).

This one has been useful to our work.

What is a STEM-focused school?

History: *Selective* Science and Math Schools for Talented Students

Public schools in US have comprehensive approach with goal of preparing all students for college, but:

- States and school districts create selective public schools with a strong science and math disciplinary focus.
- Rigorous admissions requirements.
- Local, Residential, School-within-a-school:
- See Subotnik, Tai & Almarode, 2011

New Development: *Inclusive* STEM-focused High Schools

- Have "open" admissions, fewer requirements.
- Goal: Increase minority participation in STEM.
- Provide high quality STEM learning experiences for students, and include special supports.
- Link local economies, communities, and colleges/universities: community involvement in conception and delivery.

Why are we seeing rapid growth in the creation of such schools?

- Why emphasis on serving all students, especially underrepresented populations,
  rather than historical focus on top-performing students?

The US Economy and STEM

- U.S. overtaken in developing STEM expertise, ranking 29th of 109 countries in % of 24-year-olds with a mathematics or science degree.
- Fastest growing ethnic groups in the U.S. are those least represented in STEM degree programs.
- Until recently, U.S. industry made up for shortfall in STEM degree holders by hiring scientists and engineers from overseas, but this no longer is tenable.

From Students' and Families' Views:

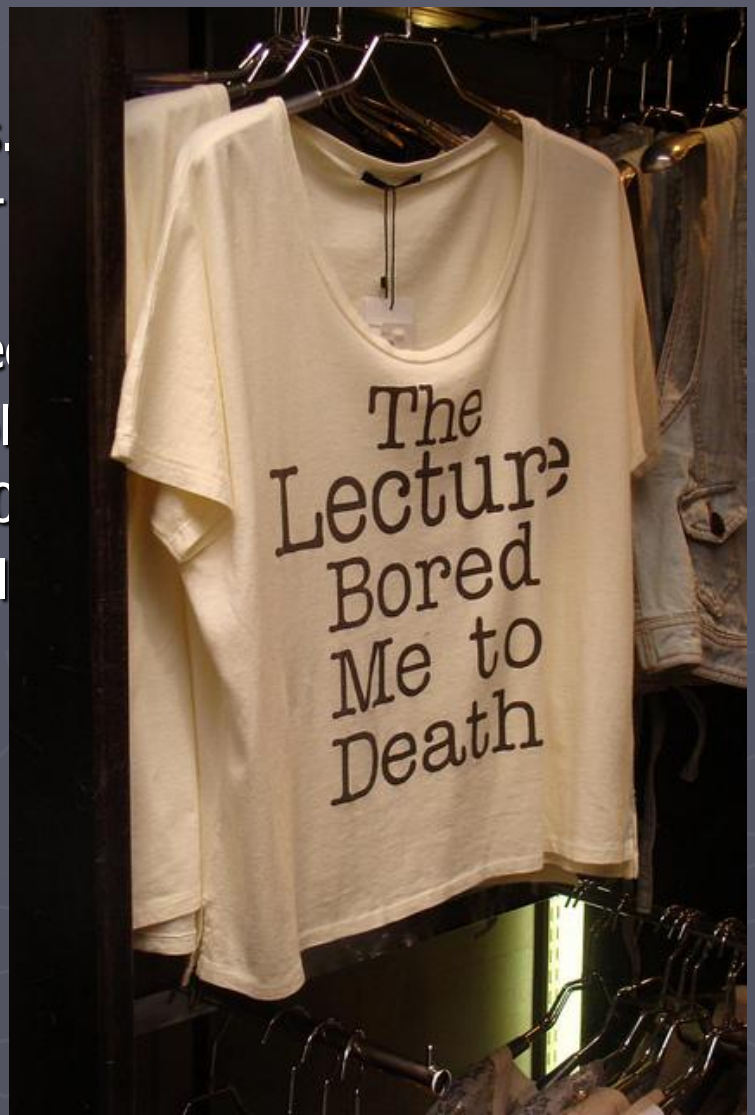
- In last decade, growth in STEM jobs was 3X greater than non-STEM jobs.
- STEM jobs will grow about 2X faster than other jobs in next 10.
- STEM workers experience less joblessness. And earn 26% more.
- About 66% of students cite intellectual challenge, good salaries, and job potential.
- Parents see US economic competitiveness and more innovation as needs.

Equity Issues

- Growing income inequality in US with fewer in middle class.
- Less social mobility in US than there used to be (last 30 years).
- Increased school segregation in US, based on income and geography.
- Schools with high proportions of minority students often have the fewest resources/teachers.
- New experiment: Make a STEM-focused school that "works" for the very groups of students who cannot access experiences needed for STEM success.

Where is the inspiration? US K-12 STEM education is *sometimes*:

- Boring.
- Does not encourage 21st Century Skills.
- Perceived to by students to be only for issues.
- STEM teachers not always well-qualifie
- Influenced by social class within school
- Has poorly constructed curriculum X 50
- Seems disconnected from the real worl



Do we know how many STEM school there are across the country?

STEM High Schools: Specialized STEM Secondary Schools in the U.S. (Means et al., 2008)

- Surveyed 203 schools and (66%) responded.
- 55% identified themselves as inclusive STEM-focused schools
- Most were stand-alone schools, but 38% were "school-within-a-school" and 20% were charter schools.
- Since 2008, there has likely been a substantial increase in Inclusive STEM-focused High Schools (ISHSs).

What is the potential of STEM schools?

What are things to watch out for?

Potential

- Create a larger number of students who are truly STEM-qualified and who pursue STEM majors and careers.
- Change "identity" of who does STEM.
- Providing STEM opportunity structures:
  - Not just "coursework" but mentoring, support structures, real world experience, early college admissions = STEM Confidence + Success.
- Influx of new ideas for STEM education.
- Choice!

Problems

- STEM-school label without fundamental changes is easy, but dangerous.
- Lessons learned from charter school movement are cautionary.
- Research challenge on measuring impact of STEM-focused schools is really HARD to do.
- Will these schools attract the most motivated students, weakening comprehensive high schools?

New Research Efforts

Two New Studies funded by NSF

On Inclusive STEM-focused High Schools

Multiple Instrumental Case Studies of Inclusive STEM-focused High Schools: Opportunity Structures for Preparation and Inspiration (OSPrI)

- NSF-funded research grant:
- Lynch, Means, Behrend, and Peters Burton

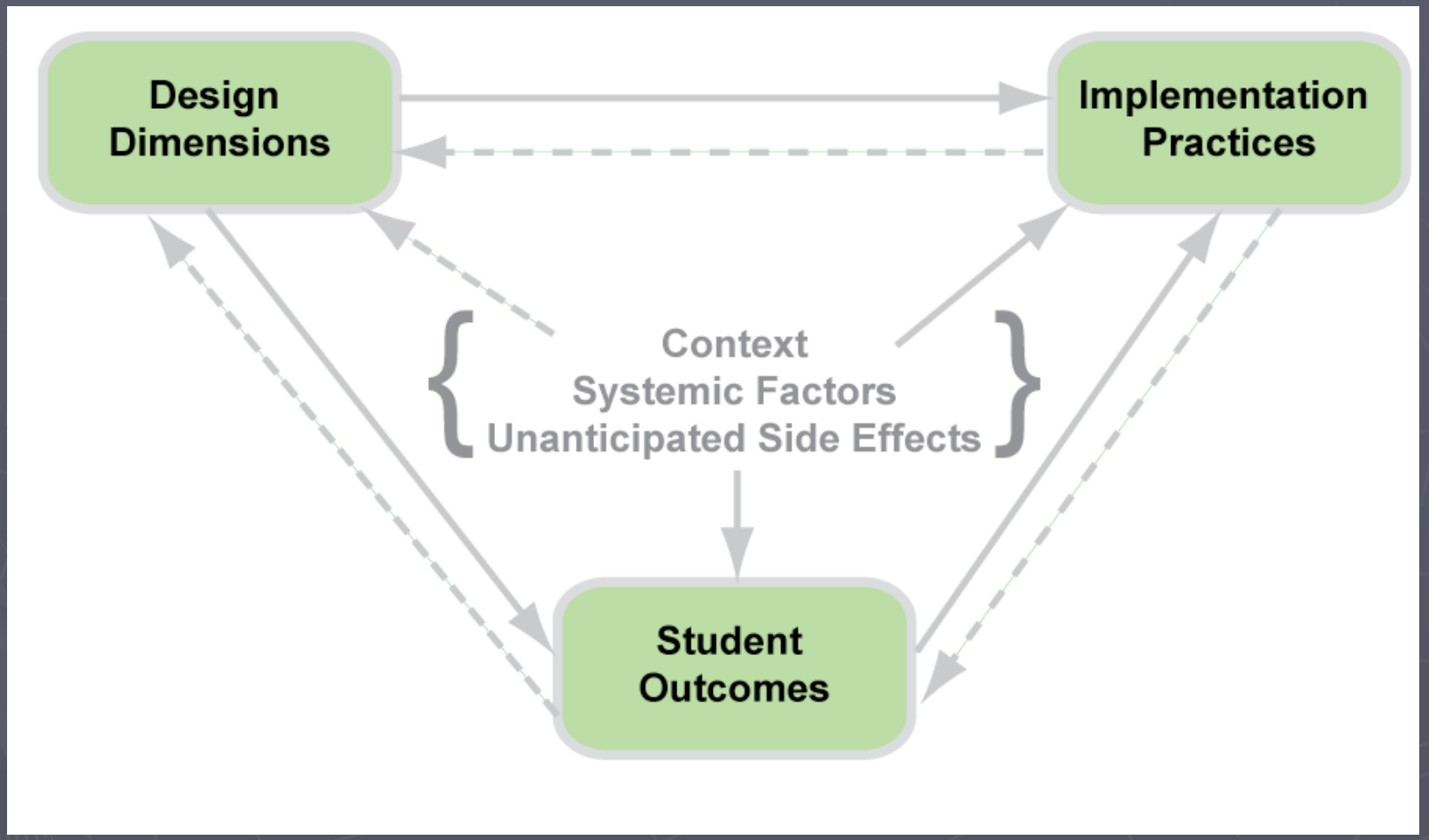
Research Problem: How do Inclusive STEM-focused High Schools create opportunity and inspiration?

- Select 12 "well-established", ISHSs and compare them, using cross-case analyses.
- Start with 10 "suspected" critical components, but capture other important elements and variations.

Candidate Critical Components

- ***1. STEM-focused Curriculum.***
- ***Reform Instructional Strategies and Project-based Learning.***
- ***3. Integrated, Innovative Technology Use.***
- ***4. Blended Formal/Informal Learning beyond the Typical School Day, Week, or Year.***
- ***5. Real-world STEM Partnerships.***
- ***6. Early College-level Coursework.***
- ***7. Well-Prepared STEM Teaching Staff.***
- ***8. Inclusive STEM Mission.***
- **9. *Administrative Structure.***
- ***10. Special Supports for Underrepresented Students.***

Conceptual Framework (Means et al., 2008)



Intended Outcomes for Phase 1 of OSPrI

- A series of instruments and protocols for 10 critical components.
- 12 rich case studies that capture different models of ISHSs.
- Uncover factors contributing to schools' success, or that limit scale and sustainability.
- Reveal how ISHSs build opportunity structures.

Related Work: More to come

- OSPrI : Compare 4 ISHSs with comprehensive high schools from **students' points of view**.
- iSTEM Study underway by Means et al. will develop a way to study the *effectiveness* ISHSs*;* follow students in ISHSs and comparisons schools from 9th grade to first year of college.

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Manor New Technology High School

Steven Zipkes, Founding Principal

The New Wave of STEM-Focused Schools

PUBLIC High School
T-STEM:
Science
Technology
Engineering
Mathematics

STEM Expectations

5 yrs. Math
5 yrs. Science
2 yrs. Engineering
Digital Portfolio
Capstone Internship
50 Hours Community Service
Trimester Schedule

New Tech

Project Based
“1:1”
Seamless Integration of Technology
Integrated Courses

345 Enrollment - Grades 9-12

54% Free & Reduced Lunch

44% Latino

32% Caucasian

22% African American

2% Asian

50% First Generation College Bound

Student Learning Outcomes

Integration of Curriculum

World Geography/ELA 1
World History/ELA 2
US History/ELA 3
Gov/Eco/ELA4

Physics/Algebra 2
Environmental Science/Statistics
Pre-Calculus/Scientific Research and Design
Biology/Physical Ed/Health
Intro to Engineering Design/Geometry
Principles of Engineering/Phys/Alg 2/PreCalc
Theatre/Digital Media Literacy

Pirate Revenge Project
IPC/Algebra I

We don't begin chapters
WE LAUNCH PROJECTS

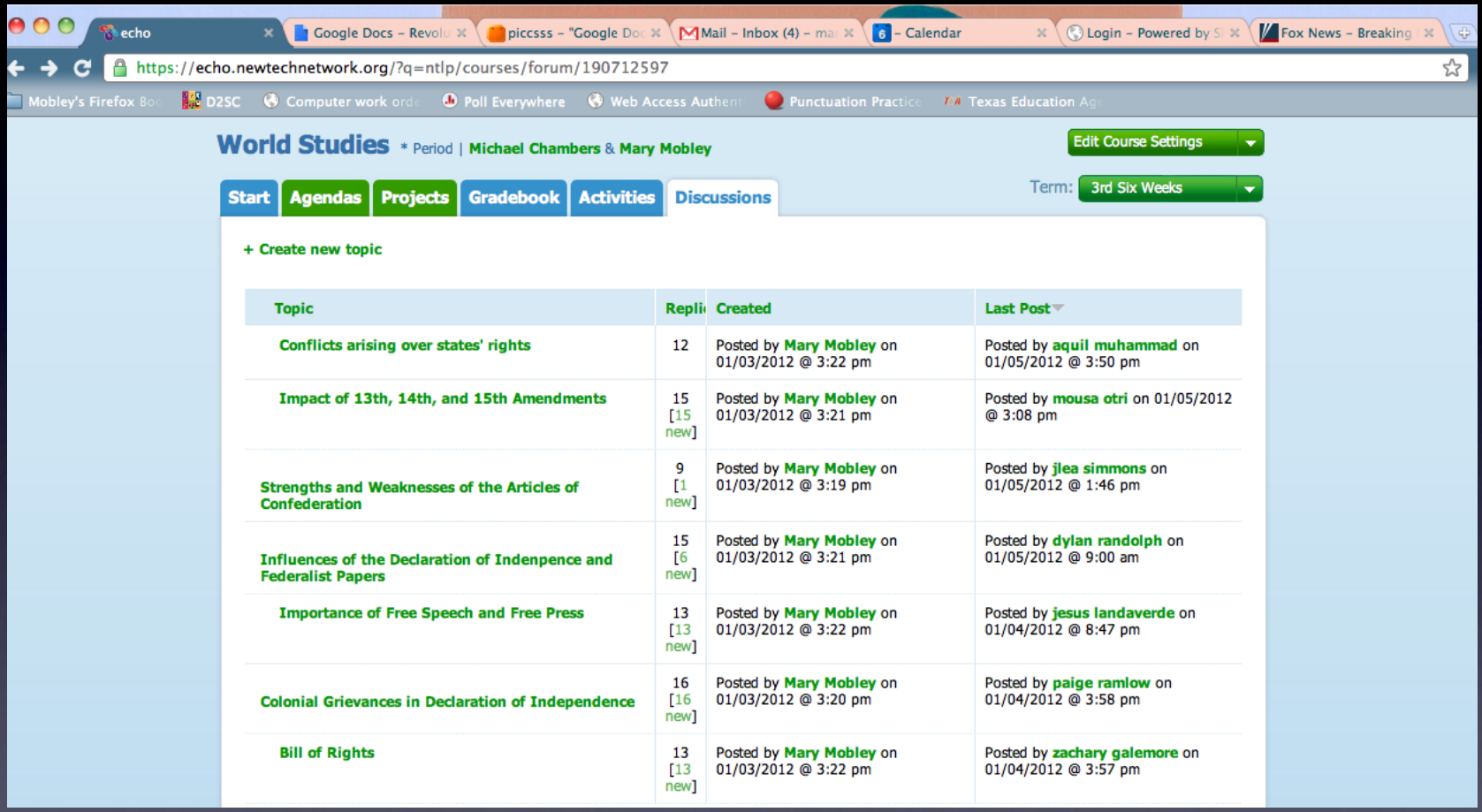
- Launch date: Halloween
- Launch activities: Students …
  - … view entry video
  - … discover new roles (greedy pirate engineers) and new goals (find maximum saved treasure)
  - … list Knows and Needs to Know

Knows:	Need to know:
We are pirates	We are going to need to know density
We are greedy - want most treasure on boats	Buoyant force
Boat can't be more dense than water or it will sink	Equilibrium
Going to make a boat	Weight versus mass
Need to gather data	How to find buoyant force
Need to do math	Due dates
	Presentation day
	Density

CRITERIA	UNSATISFACTORY (Below Performance Standards)	PROFICIENT (Minimal Criteria)	ADVANCED (Demonstrates Exceptional Performance)
Description **World Geography** **4.** The student understands the patterns and characteristics of major landforms, climates, and ecosystems of Earth and the interrelated processes that produce them. **(A)** Explain the distribution of different types of climate in terms of patterns of temperature, wind, and precipitation and the factors that influence climate regions such as elevation, latitude, location near warm and cold ocean currents, position on a continent, and mountain barriers;	Students (*group*) do not demonstrate an understanding of various landforms because their "new planet" contains fewer than: · 3 continents · 2 mountain ranges · 4 river systems 1 of them major · 2 Lakes (5 reservoirs) · 1 canyon · 1 desert · 2 major valleys · 1 Temporal forest · 1 tropical rain forest	**PLANET ILLUSTRATION/MODEL** Students (*group*) create a "new planet" containing landforms: Students demonstrate an understanding of various landforms by illustrating: · 3 continents - 2 mountain ranges - 4 river systems 1 of them major - 2 lakes (5 reservoirs) - 1 canyon - 1 desert - 2 major valleys - 1 temporal forest - tropical rain forest	In addition to meeting the PROFICIENT criteria… Students (*group*) will demonstrate complete understanding of how climate affects the distribution of plants and animals by creating their own species of plants and animals: • Create a habitat for the animals and plants based on climatic, as well as geographic adaptations. • Create at least 10 new species of plants as well as 10 species of animals.
Work ethic/Collaboration/WG Content	**0 - - - - - - - - - - - 5 - - - - - - - - - - - 8**	**9 - - - - - - - - - - - 15 - - - - - - - - - - - 24**	**25 - - - - - - - - - - -28 - - - - - - - - - - - 30**
Description **English** E1.2 Students analyze, make inferences and draw conclusions about theme and genre in different historical, cultural context. E1.2C Relate the figurative language of a literary work to its historical and cultural setting. E1.4 Students understand, make inferences and draw conclusions about the structure and elements of drama. E1.5A Analyze non-linear plot development. E1.5B Analyze how authors devlop complex yet believable characters in works of fiction. E1.5C Analyze the way in which a work of fiction is shaped by the narrator's point of view. E1.7 Students understand, make inferences and draw conclusions about how an author's sensory language creates imagery in literary text.	Student (*individual*) journal contains few, if any, of the following: • A detailed map of the journey he/she took while re-building Odysseus' planet. • A minimum of 5 journal entries, which include: - The date of your imaginary travels - Exact map location including the latitude and longitude - Interesting facts about the location including names of people, places, things, etc. - A brief story about the adventure that happened to you at each of the five locations (be creative) - Reflection about his/her time spent there - Links to The Odyssey, whether it be characters, places, events, etc. • Include at least 10 Geography and English vocabulary terms	**PERSONAL ODYSSEY JOURNAL** Student (*individual*) writes a journal that details his/her own fictional odyssey. This will be included in the Writing Portfolio and contain the following: • A detailed map of the journey he/she took while re-building Odysseus' planet. • A minimum of 5 journal entries, which include: - The date of your imaginary travels - Exact map location including the latitude and longitude - Interesting facts about the location including names of people, places, things, etc. - A brief story about the adventure that happened to you at each of the five locations (be creative) - Reflection about his/her time spent there - Links to *The Odyssey*, whether it be characters, places, events, etc. - Include at least 10 Geography and English vocabulary terms from his/her vocabulary list.	In addition to meeting the PROFICIENT criteria … Student map is interactive in some manner. Student writes from a unique perspective (i.e., from the viewpoint of a character in *The Odyssey*, Student incorporates illustrations of the habitat, environment, flora, and/or fauna of that region in the journal entries (i.e., a "crumple-horned snrokack" – be creative).
English Content/Written Comm.	**0 - - - - - - - - - - - 15 - - - - - - - - - - - 27**	**28 - - - - - - - - - - - 31 - - - - - - - - - - - 34**	**35 - - - - - - - - - - -37 - - - - - - - - - - - 40**

Blended Learning

Blended Learning

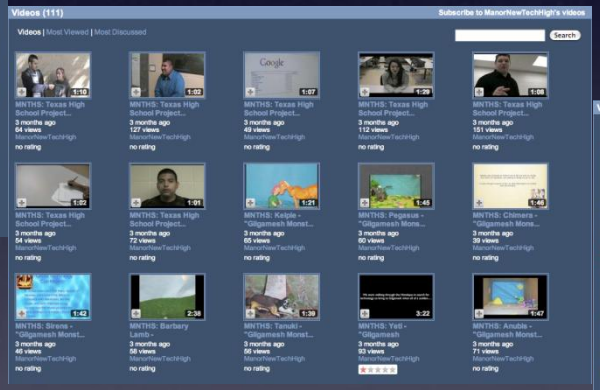


Blended Learning

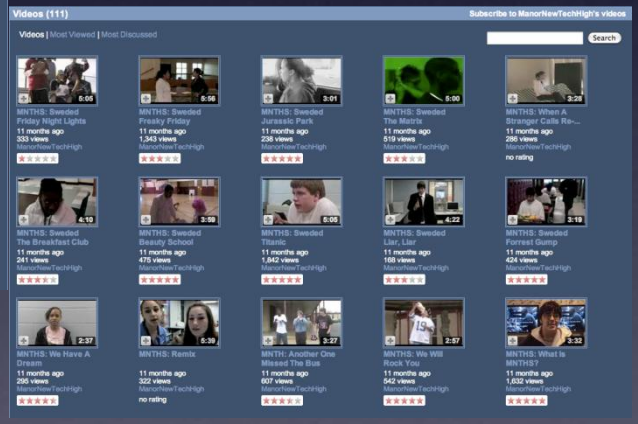
Student Content: Over 1086 Videos

Student Products

Teacher Quality



21st Century Skills



http://www.youtube.com/ManorNewTechHigh

Validation

EDUCATION EQUALS ECONOMICS
E3 ALLIANCE

TEXAS STATE UNIVERSITY
SAN MARCOS

Charles A. Dana Center
The University of Texas at Austin

Improving education for all students

International Center for Leadership in Education

The Achievement Gap Initiative at Harvard University
Toward Excellence with Equity

“Or consider Manor New Tech High School in Manor, Texas, as a model for reaching under served youth.”

U.S. Secretary of Education Arne Duncan at the Association of American Publishers Annual Meeting

Students

97% Attendance Rate
0% Dropout Rate
65 Public Speeches yearly
75% Seniors, 68% Juniors in Dual Credit Classes

100% Completion
100% Senior Class of 2010 College/University Bound
84% Accepted into 4 year Universities
62% First Generation

100% Completion
97% Senior Class of 2011 College/University Bound
80% Accepted into 4 year Universities
50% First Generation

MNTHS Cohorts

Class of 2010	% Met Standard ELA	% Met Standard Math	% Met Standard Science	% Met Standard Social Studies
9th	86	64	NA	NA
10th	96 ↑	78 ↑	85	96
11th	95 ↓	84 ↑	95 ↑	98 ↑

Class of 2011	% Met Standard ELA	% Met Standard Math	% Met Standard Science	% Met Standard Social Studies
8th	77	59	65	90
9th	87 ↑	64 ↑	NA	NA
10th	90 ↑	67 ↑	84 ↑	98 ↑
11th	90 →	84 ↑	94 ↑	99 ↑

Class of 2012	% Met Standard ELA	% Met Standard Math	% Met Standard Science	% Met Standard Social Studies
8th	80	61	78	90
9th	93 ↑	73 ↑	NA	NA
10th	90 ↓	77 ↑	84 ↑	98 ↑
11th	99 ↑	90 ↑	97 ↑	97 ↓

Manor New Technology High

We Don’t Teach Old School


Q&A

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The New Wave of STEM-Focused Schools

Required Reading from *Education Week*:

Latest Wave of STEM Schools Taps New Talent
The schools are casting a wider net to develop the talents of girls, minorities, and disadvantaged students.